Claims:

1. A method of enhancing detection for a specific object in a body, comprising the steps of:

(a) administering to said body for detection of the object, if present, a nanoparticulate, the nanoparticulate having the following properties:

i. it is at least partially metallic,

ii. it has a formed non-spherical shape having a minimal characteristic dimension in the range from about 1 to about 3000 nanometers,

iii. it has a formed composition capable of producing thermal pressure either in said nanoparticulate or in said object greater than said object could produce as a result of step (b) in the absence of said nanoparticulate; and

(b) directing onto said body specific electromagnetic radiation having a wavelength or spectrum of wavelengths in the range from 300nm to 300mm selected so that the wavelength or wavelength spectrum is longer by a factor of at least 3 than the minimum characteristic dimension of said nanoparticulate,

said nanoparticulate absorbing said electromagnetic radiation more than would one or more non-aggregated spherically shaped particles of the same total volume with a composition identical to said nanoparticulate,

said nanoparticulate by such absorption producing an enhanced optoacoustic signal resulting from said absorption.

2. The method of claim 1 further comprising:

(d) receiving said optoacoustic signal,

(e) converting said received optoacoustic signal into an electronic signal characterized by at least one parameter selected from amplitude, frequency, phase, temporal profile, time of arrival, frequency spectrum, or a combination of any one or more of such parameters; and

(e) presenting said signal for assessment of said at least one parameter by a human or a machine.

3. A method of enhancing detection for a specific object in a body, comprising the steps of:

(a) administering to said body for detection of the object, if present, a nanoparticulate, the nanoparticulate having the following properties:

i. it is at least partially metallic,

ii. it has a formed non-spherical shape having a minimal characteristic dimension in the range from about 1 to about 3000 nanometers,

iii. it has a formed composition capable of producing thermal pressure either in said nanoparticulate or in said object greater than said object could produce as a result of step (b) in the absence of said nanoparticulate; and

(b) directing onto said body specific electromagnetic radiation having a wavelength or spectrum of wavelengths in the range from 300nm to 300mm selected so that the wavelength or wavelength spectrum is longer by a factor of at least 3 than the minimum characteristic dimension of said nanoparticulate,

said nanoparticulate absorbing said electromagnetic radiation more than would one or more non-aggregated spherically shaped particles of the same total volume with a composition identical to said nanoparticulate,

said nanoparticulate by such absorption producing an enhanced optoacoustic signal resulting from said absorption, and

(c) receiving said optoacoustic signal.

4. The method of claim 3 further comprising:

(d) converting said optoacoustic signal into an electronic signal characterized by at least one parameter selected from amplitude, frequency, phase, temporal profile, time of arrival, frequency spectrum, or a combination of any one or more of such parameters; and

(e) presenting said signal for assessment of said at least one parameter by a human or a machine.

5. The method of claim 1 in which interaction of said nanoparticulate with said object produces a shift of the absorption maximum by said nanoparticulate for said selected wavelength or range of wavelengths.

6. The method of claim 1 in which said nanoparticulate is a collection of nanoparticles characterized in having a most probable size and a most probable absorption maximum at a selected wavelength or range of wavelengths.

7. The method of claim 6 in which said collection of nanoparticles has a most probable aspect ratio of from about 2 to about 10.

8. The method of claim 6 in which the longest dimension of said most probable nanoparticles is in the range from about 2 nanometers to about 200 nanometers.

9. The method of claim 5 in which said nanoparticles have a plurality of size distribution modes.

10. The method of claim 6 in which said nanoparticles are combinations of nanoparticles of one shape with nanoparticles of another shape to form geometries capable of absorbing a selected specific wavelength or range of wavelengths.

11. The method of claim 1 in which said nanoparticulate comprises a nanoparticle aggregate.

12. The method of claim 11 in which aggregate includes spherical nanoparticles.

13. The method of claim 11 in which said aggregate is ordered and in which said nanoparticles are at least partially coated with organic material, such organic material comprising genetic material.

14. The method of claim 6 in which said metal of said collection of at least partially metallic nanoparticles is selected from gold, silver, platinum, a form of carbon having metallic properties, a mixture of at least two of said metals, or an alloy of at least two of said metals.

15. The method of claim 6 in which said collection of nanoparticles has a most probable size of less than 1000 nanometers.

16. The method of claim 6 in which said collection of nanoparticles has a most probable size of less than 300 nanometers.

17. The method of claim 6 in which said collection of nanoparticles has a most probable size of less than 100 nanometers.

18. The method of claim 6 in which said nanoparticles are solid.

19. The method of claim 6 in which said nanoparticles comprise shells having a negative value of the real part of the complex dielectric permeability.

20. The method of claim 19 in which said shells have a dielectric core.

21. The method of claim19 in which said nanoparticles have a core with a negative value of the real part of the complex dielectric permeability.

22. The method of claim 19 in which the shells are filled with a substance having a coefficient of thermal expansion in the range of 9×10^{-2} mm^3/joule to 2×10^3 mm^3/joule.

23. The method of claim 22 in which said substance is selected from the group comprising water, aqueous gels, hydrogels, gases, lipids and other organic substances.

24. The method of claim 6 in which said nanoparticles are at least partially coated with one or more organic materials.

25. The method of claim 24 in which said nanoparticles are at least partially coated with one or more biological materials.

26. The method of claim 24 in which said organic material is bound to the surface of the nanoparticles physically or chemically or both.

27. The method of claim 24 in which said organic material is ambiphilic.

28. The method of claim 24 in which said organic material comprises block copolymers in which one block is polyethylene glycol.

29. The method of claim 24 in which said organic material includes reactive functional groups, including hydroxyl groups, thiol groups, amine groups, hydroxyl, halo, cyano groups, sulfhydryl, carboxyl, and carbonyl groups, carbohydrate groups, vicinal diols, thioethers, 2-aminoalcohols, 2-aminothiols, guanidinyl, imidazolyl and phenolic groups.

30. The method of claim 24 in which said organic material comprises peptides or antibodies conjugated to said particles and capable of selectively targeting specific

markers of the object, wherein said marker comprises vascular endothelial growth factor, epidermal growth factor receptor, HER2/neu receptor, folate receptor, human milkfat protein, annexin-5, proliferating cellular nuclear antigen.

31. The method of claim 6 in which said particles are coated with inorganic material.

32. The method of claim 1 in which said wavelengths are in the visible and near infrared spectrum.

33. The method of claim 32 in which said spectrum is in the wavelength range from 650 nanometers to 1150 nanometers.

34. The method of claim 33 in which the particles comprise gold and the wavelength for irradiation is from about 520 nanometers to about 1120 nanometers.

35. The method of claim 34 in which the most probable aspect ratio of said collection of gold particles is at least 2.0.

36. The method of claim 35 in which said particles comprise gold and have a bimodal distribution of aspect ratios.

37. The method of claim 36 in which one local maximum in the distribution of aspect ratios is about 4 and the other local maximum in the distribution of aspect rations is about 8.

38. The method of claim 37 in which said electromagnetic radiation comprises two or more wavelength spreads.

39. The method of claim 38 in which one wavelength band is from about 690 nanometers to about 800 nanometers and another wavelength band is from about 800 nanometers to about 1150 nanometers.

40. The method of claim 1 in which said wavelength of electromagnetic radiation is chosen to match the maximum of absorption for particles at least partially coated with organic or inorganic dielectric material.

41. The method of claim 1 in which said optoacoustic signal is produced through plasmon derived resonance absorption by conductive electrons in said at least one nanoparticulate.

42. The method of claim 41 in which the electromagnetic radiation is pulsed and emitted from a pulsing laser.

43. The method of claim 41 in which the electromagnetic radiation is a modulated continuous wave.

44. The method of claim 1 in which said body is in an animate human or non-human body.

45. The method of claim 1 in which said body is an in vitro specimen.

46. The method of claim 1 in which said object is biological.

47. The method of claim 52 in which said object comprises a specific tissue, cell, microorganism or molecule.

48. The method of claim 1 in which said step of introducing comprises administering said agent to accumulate in a specific tissue, cell or microorganism.

49. The method of claim 1 in which said object is at least one tumor in an animate human or non-human body.

50. The method of claim 1 in which said object is at least one virus.

51. The method of claim 1 in which said object is at least one bacterium.

52. The method of claim 1 in which said object is a physiologically operative molecule comprising glucose, an enzyme, a protein receptor, or a nucleic acid.

53. The method of claim 1 further comprising generating a two-dimensional or three dimensional image from said detected signal.

54. A method of generating an image of an animate human or non-human animal body or part thereof, comprising

(a) administering to said body a physiologically tolerable contrast agent comprising a collection of at least partially metallic particles having a most probable size no smaller than about 1 nanometers and no larger than about 1000 nanometers and a formed shape capable of absorbing specific selected wavelengths of electromagnetic radiation,

(b) exposing said body or part thereof to electromagnetic radiation in the near-infrared range of wavelength spectrum having a selected wavelength or range of wavelengths larger by a factor of at least 5 relative to the minimal size of said particles,

(c) detecting a optoacoustic signal generated in said body as a result of heating said collection of at least partially metallic particles, and

(c) generating an image from said detected signal.

55. The method of claim 59 in which the conversion of said optoacoustic signal into said electronic signal is made through a detector selected from thermal, acoustic, optical or infrared detectors or a combination of such detectors.

56. A method of non-invasively detecting and treating a tumor of an animate human or non-human animal body or part thereof, comprising

(a) administering to said body or a part thereof in a manner to position where presence of a tumor is to be examined a physiologically tolerable contrast agent comprising a collection of at least partially metallic particles having a most probable size no smaller than about 1 nanometers and no larger than about 1000 nanometers and a formed shape capable of absorbing specific selected wavelengths of electromagnetic radiation,

(b) exposing said body or part thereof to electromagnetic radiation in the near-infrared range of wavelength spectrum having a selected wavelength or range of wavelengths larger by a factor of at least 5 relative to the minimal size of said particles,

(c) detecting a optoacoustic signal generated in said body as a result of heating said collection of at least partially metallic particles,

(d) converting said optoacoustic signal into an electronic signal characterized by at least one parameter selected from amplitude, frequency, phase, temporal profile, time of arrival or frequency spectrum or a combination thereof,

(e) presenting said signal for assessment of said at least one parameter by a human or a machine for whether a tumor is present in said body, and

(f) directing onto said particles a selected wavelength or range of wavelengths minimally absorbed by material of the body in order to heat said particles at said tumor and produce enhanced optoacoustic effect sufficient to destroy viability of said tumor.